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# PINK BOLLWORM INFORMATION

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## COOPERATIVE RESEARCH ON THE PINK BOLLWORM AND RELATED COTTON INSECTS

Distributed occasionally by
the Pink Bollworm Research Center,
Brownsville, Texas

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# PINK BOLLWORM INFORMATION

Purpose: This circular of information on the pink bollworm is intended to give agricultural officials who are concerned with this cotton pest a concrete idea of the status of the insect and keep them up to date on progress on various research projects. The problem is of such vital interest that everyone to whom this circular is sent should read it and should send criticisms or suggestions to Dr. Fred C. Bishopp, Coordinator, Pink Bollworm Research, Box 1033, Brownsville, Texas.

The Problem and How It is Being Attacked: The pink bollworm is now present over a considerable part of the cotton belt of the United States (see map). It is regarded as the world's worst cotton pest and its ability to inflict severe damage to cotton in the United States has been fully demonstrated. The pink bollworm problem in this country is intensified by the presence of a number of other destructive pests including the boll weevil and bollworm.

The importance of developing additional practical methods of controlling the pink bollworm under the diverse climatic and agricultural conditions in various parts of this country is obvious. To meet this situation, and at the urgent request of the National Cotton Council and many Governmental and private agencies, the then Bureau of Entomology and Plant Quarantine, U.S. Department of Agriculture, took steps in 1951 to expand its research program and make provision for more adequate housing and facilities as well as for additional personnel. Through cooperation with Southmost College and business

interests in Brownsville, arrangements were made for the establishment of the Pink Bollworm Research Center on the abandoned Army Post, Fort Brown, on the edge of Brownsville, Texas.

Financial Support: The states of Texas, Arkansas, Georgia, and Alabama are now contributing financial support to the pink bollworm research program, and Mississippi will soon join this group with funds recently appropriated. The Oscar Johnston Cotton Foundation is also giving direct financial aid. The major funds, however, are still supplied by the U.S. Department of Agriculture. Steps are being taken by other cotton growing states to participate. The National Cotton Council has recognized the seriousness of the pink bollworm as a threat to the economical production of cotton in this country and has been active in efforts to get cotton growing states to provide support of research and to initiate a greatly expanded and coordinated research program.

Facilities and Location: The Pink Bollworm Research Center consists of a 26-room air-conditioned office and laboratory building, a building housing five bio-climatic cabinets where temperatures and humidities similar to those existing in other areas can be maintained, a greenhouse with headhouse, an insecticide building, a small insectary, a half-acre screen cage, a small field for conducting cage and small-plot experiments, and adjacent buildings for a shop and for storing equipment, heavy supplies and automobiles. Water for irrigation is provided by shallow wells. Although the office building was occupied in November 1953, the laboratories are not yet completely furnished and improvements are still being made. The greenhouse, insectary, large cage and plots are now being fully utilized.

The Center was dedicated on January 24, 1954. Participating in the dedication program were Dr. S. B. Fracker representing the Secretary of Agriculture, Ing. Mauro Ruiz Ayala representing the Minister of Agriculture of the Republic of Mexico, The Honorable Allen Shivers, Governor of Texas, The Honorable Lloyd M. Bentsen, Jr., Member of Congress, 15th District of Texas, Doctor R. D. Lewis, Director, Texas Agricultural Experiment Station, The Honorable Harold Hutton, Commissioner of Agriculture of Oklahoma, Mr. G. G. Gibson, Director, Texas Agricultural Extension Service, Mr. Paul Mayfield, President, National Agricultural Chemicals Association, Dr. Clay Lyle, Director, Mississippi Agricultural Experiment Station and Extension Service, and Dr. H. G. Johnston, Head of Research Development, National Cotton Council of America. Dr. F. C. Bishopp welcomed the visitors and introduced the speakers.

Sublaboratories are located at Port Lavaca, Lubbock, Texas, and Torreon, Mexico. The first is somewhat representative of areas with a shorter growing season and higher rainfall, the second of the great plains cotton area, and the last of an old infested area in a higher altitude where the crop is all raised under irrigation.

Several phases of the research are carried out at College Station, Texas, at Texas sub-experiment station No. 15, Weslaco, Texas, and at Mesilla Park, New Mexico. Hibernation tests are underway at Waco, Greenville, Vernon, and Mount Pleasant, Texas, and at Chickasha, Oklahoma, in addition to Brownsville, Port Lavaca, and Lubbock, Texas.

Cooperation: Close cooperation is maintained by research workers with the Pink Bollworm Control Project, engineers and plant experts of the various departments of the Texas Agricultural Experiment Station, and the U.S. Department of Agriculture. Without the full cooperation of cotton farmers, gin and oilmill men, and other industry representatives the research program would be greatly handicapped. As previously indicated, the Experiment Stations of Alabama, Arkansas, Georgia, and Texas are supporting the research financially, and Mississippi has made an appropriation for this purpose. The personnel of these stations are contributing suggestions on the work program. Similar suggestions are welcomed from other agencies in the cotton belt including experiment stations, State Departments of Agriculture, and quarantine officers.

Meetings Attended by Research Personnel - 1954: The Center was represented at the Cotton States Branch, Entomological Society of America, meeting in Biloxi, Mississippi, January 24-25 by F. C. Bishopp who gave a talk on the pink bollworm research program. The following men attended the Southwestern Branch, Entomological Society of America, meeting in Dallas, Texas, February 1-3. Papers, mainly on the pink bollworm, were presented by R. L. McGarr, O. T. Robertson and D. H. Currie, P. A. Glick and J. P. Hollingsworth, M. J. Lukefahr and J. P. Hollingsworth, A. J. Chapman and L. W. Noble, and H. F. Beckman. F. C. Bishopp also made a talk on the program of the National Agricultural Chemicals Association in Houston, Texas on March 24-26, and at the Southwest Branch of the Texas Academy of Science in Corpus Christi April 2-3.

The 41st Annual Convention of the Texas Cotton Ginners' Association in Dallas, Texas, was attended by D. H. Currie, O. T. Robertson, and F. C. Bishopp. D. H. Currie and C. N. Husman went to the Ginners' School in Dallas April 19-20.

Personnel: Regular personnel is shown at the back of this circular. Jack D. Sherrer, employed on Arkansas State funds, returned to Port Lavaca the first part of May. He has been working at the Arkansas Experiment Station and teaching at the University during the winter. James A. Griffin, employed on Alabama State funds, reported to Brownsville on April 6, 1954. He has been reviewing literature, etc. at Alabama Polytechnic Institute for the past few months. William J. Magee, entomologist, and Marc Davenport, engineer, employed by Texas Experiment Station, are carrying on research on the experiment station projects at College Station, Weslaco and Port Lavaca.

T. R. Pfrimmer left Brownsville April 29 for his new position at the Tallulah, Louisiana Laboratory for work primarily on the boll weevil. W. J. Eitel has been transferred from Lubbock to Brownsville to assume some of the duties previously handled by Dr. Pfrimmer.

Visitors: At the open house and dedication of the Pink Bollworm Research Center nearly 1,000 visitors were present. A considerable number of people representing State Experiment Stations and various branches of the Department of Agriculture and industry have visited the Center since the dedication. The majority of these were representatives of various industries having a direct interest in the pink bollworm problems.

Mr. Mahmet Yuksel of the Turkish Department of Agriculture spent a few months studying the pink bollworm problem. Mr. Francisco A. Estrada, Technical Agricultural Service of Nicaragua, and Ubiratan Pompeo Sa, Agricultural Engineer from the State of Parana, Brazil, spent two weeks during April and May conferring with workers and observing the research underway at the Center. The latter two men were studying in this country under the auspices of the Foreign Operations Administration.

STATUS OF PINK BOLLWORM CONTROL AS OF APRIL 1, 1954 (L. F. Curl)

Pink Bollworm Control - A Cooperative Effort: Since the first discovery of pink bollworm in Texas in 1917, the dependence of the Federal agency upon its State cooperators and in turn the dependence of affected States on adequate Federal participation has been justly recognized. The fact that the pink bollworm exists in both Mexico and the United States has given recognition over the years to the fact that the fight against this insect is a common problem of the two countries. The pink bollworm control project has through the

years, in addition to cooperating with Mexico and the affected States, cooperated to the fullest extent with other agencies of the Federal Government, particularly with those responsible for pink bollworm research and with growers and the cotton industry.

Review of Infestation in the United States: The pink bollworm was first introduced into the United States through shipments of infested cotton seed from the 1916 crop of the Laguna section of Mexico. The first field finding was at Hearne, Texas in September 1917. Additional findings were made throughout the upper Texas gulf coast area later in the fall. Infestation was discovered in the 1919 crop in southwestern Louisiana and near Shreveport. These earliest infestations were all eradicated. Additional successes in eradication of this insect occurred in Salt River Valley of Arizona, from which area it has been eradicated twice. Eradication efforts were likewise successful in northern Florida and south central Georgia in the mid 1930's.

The discovery of the pink bollworm in the lower Rio Grande Valley of Texas and Mexico has proven to be a turning point with respect to restricting the spread of this insect in the United States. Since this original outbreak in 1936, the pink bollworm has traveled by natural means across the remainder of Texas, into Oklahoma, Louisiana, and in 1953 into the state of Arkansas.

Pink Bollworm Distribution and Abundance: The attached map shows the areas in Texas where the pink bollworm is now known to occur. All of the counties in South Texas from Val Verde to Lavaca inclusive and south to the Rio Grande and Gulf are designated as

heavily infested. Counties in the Big Bend from Reeves and Ward to the Rio Grande are also designated as heavily infested. All the areas in Arizona, New Mexico, Oklahoma, Arkansas, Louisiana, and the remainder of Texas have only extremely light infestation.

The pink bollworm quarantine includes all of Oklahoma and a number of counties beyond the known infested areas. The inclusion of such counties is designed to give better protection because of movement into them of cotton from beyond their borders for ginning, and for administrative reasons. As an example, in the fall of 1953 the pink bollworm was found in Miller and Hempstead Counties in Arkansas. However, it was necessary to place eight counties of southwest Arkansas under regulations.

Spring inspections show some increase in survival of pink bollworms in debris in northeastern Mexico but the amount of material to harbor that insect is materially less than in previous years. Consequently, it appears there will be fewer surviving pink bollworms to infest the new crop than there has been during the past three years. In the cultural control area of south Texas there is a decrease in the survival rate and in material available for overwintering. Ten central and east Texas counties show an increase in survival rate over that rate in the spring of 1953 and no counties show decreases. A better clean-up of cotton in the fields, however, should result in a lower pink bollworm population per acre to infest the 1954 crop.

Control Program Objectives: A primary responsibility of the control project is to conduct surveys throughout the entire cotton growing areas of the United States, including the quarantined area. It is essential to locate incipient infestations at the earliest possible time so that control and regulatory measures may be undertaken promptly. It is important to know the exact status of infestation in the regulated areas in order adequately to plan suppressive measures.

An equally important responsibility is to suppress infestation to prevent spread. Suppressive measures involve cultural practices, particularly, deep plowing, planting dates, stalk destruction dates, maintenance of host free periods and in some instances application of insecticides during the growing season.

The treatment and certification of products in the enforcement of the Federal pink bollworm quarantine is a vital part of the plan to prevent the pink bollworm from becoming established throughout the United States. Cotton seed is heat treated or fumigated; cotton lint is compressed; mechanical cotton pickers, gin machinery, and other articles likely to carry pink bollworm are cleaned and fumigated before certification for free movement. Sanitation at processing plants is likewise an essential requirement to prevent contamination of treated products. There are 2350 gins in the quarantine area, of which number close to 1300 are equipped to treat cotton seed as a continuous process of ginning. There are also 125 oil mills, close to 50 fumigation plants, nearly 200 compresses and warehouses in the regulated areas

requiring supervision. Adequate enforcement of the regulations also involves traffic inspection of migratory cotton pickers and others who might be carrying infested cotton or its products.

THE TEXAS AGRICULTURAL EXPERIMENT STATION (J. C. Gaines)

1. Development of Stalk Cutter-Shredders: Results of experiments conducted last fall indicate that none of the cutter-shredders on the market would kill over 70% of the pink bollworms during the shredding operations. Improvements have been made on the best shredder during the winter months. It is planned to carry the machine to Mexico for testing during May. Later in the season, this machine with improvements will be used in tests at Weslaco and Port Lavaca.

M. G. Davenport, Agricultural Engineer
W. J. Magee, Entomologist

2. Development of Sprayers and Dusters: Arrangements have been made to conduct experiments for this purpose at both Port Lavaca and Weslaco. Plantings of cotton have been made at both locations for these experimental tests. Records of insect populations will be initiated at an early date. Sprays and dusts will be used when infestations warrant. The replicated experiments have been designed to evaluate three and five spray nozzles per row, three different volumes of spray per acre, and one and two dust nozzles per row for pink bollworm control. Dieldrin or dieldrin-DDT will be used in all experiments for weevil and pink bollworm control.

W. J. Magee, Ento. (Port Lavaca)
G. P. Wene, Ento. (Weslaco)
M. G. Davenport, Agric. Eng. (at present College Station, Port Lavaca after June 15)

3. Resistance Studies: Field cage studies of resistance of 15 varieties of cotton to the pink bollworm have been made at College Station. Additional varieties will be included in further studies. Photoperiodic varieties are being screened for resistances. Factors being investigated are mode of entry of larvae, extent of tunneling in carpel, percent of larvae effecting penetration of bolls through carpel lining, percent making entry at sutures, and mortality of larvae before and after entry of bolls. The relationship of certain characteristics of the cotton plant and bolls to behavior of larvae and egg laying habits of the adults are being studied.

J. R. Brazzel, Grad. Asst. Ento.
(College Station)

4. Evaluation of Growth Inhibitors: The regrowth of cotton following boll opening furnishes squares and young bolls for a late buildup of the pink bollworm populations. To this end, approximately 30 chemical formulations have been screened in the laboratory at College Station for their ability to inhibit regrowth. Four of these compounds show promise on the basis of limited greenhouse tests. Further tests will be conducted in the field at College Station this spring. The more promising compounds on the basis of field tests will be used in the Weslaco and Port Lavaca test plots later in the growing season.

S. P. Johnson, Plant Physiologist
(College Station)

5. Evaluation of Treatment Combinations for Pink Bollworm Control: Two ages of cotton will be used for these tests. The early planting was made March 10 and a later planting was made April 20. This experiment located at Port Lavaca consists of 32 plats, each treatment replicated 4 times. These treatment combinations are as follows: (1) no treatment, (2) insecticide, (3) defoliant, (4) stalk cutter-shredder, (5) insecticide plus defoliant, (6) insecticide plus stalk cutter-shredder, (7) defoliant plus stalk cutter-shredder and (8) insecticide plus defoliant plus stalk shredder.

W. J. Magee, Ento. (Port Lavaca)
M. G. Davenport, Agric. Eng. (College Station and Port Lavaca)
S. P. Johnson, Plant Phys. (College Station)

PINK BOLLWORM RESEARCH CENTER AND SUBLABORATORIES

Insecticides (C. A. Richmond, R. L. McGarr, M. L. Lowry, O. L. Walton, and J. A. Griffin): Surveys of cotton fields for the purpose of finding a number that are sufficiently infested and otherwise suitable for insecticide tests were begun as soon as the cotton started to bloom. Only relatively light infestations of the pink bollworm have been found, but under weather conditions favorable to the insect, marked increase is expected. Checks are also being made on aphids, thrips, bollworms, and other insects that interfere with an early set of bolls.

The effect of chlor-methyl-urea (CMU), 2,4-D, and other weed killing agents on pink bollworm larvae and adults are underway primarily for the purpose of determining if such materials can be used to keep down vegetation in hibernation cages without affecting pink bollworm emergence.

Biological Control (J. M. McGough): Imported parasites of the pink bollworm were liberated in the Presidio Valley of Texas and interior of Mexico during the period, 1932-44. Of 7 species released in large numbers, none became established. Following the recent build-up in pink bollworm infestation in southern Texas, work with foreign parasites and predators was resumed with the hope that conditions in this area might be more favorable for the parasites to maintain themselves. Mr. G. W. Angelet, of the Section of Bee Culture and Biological Control, was assigned the collection of promising pink bollworm parasites and predators in India for shipment to the quarantine station of the above Section at Moorestown, New Jersey. The breeding stocks received are examined for hyperparasites, bred up and shipped to Brownsville, for further propagation and colonization in the field.

During 1953 a total of 352,446 adults of *Bracon brevicornis*, *B. gelechiae*, *Apanteles* sp., and two *Chelonus* spp. were liberated at 378 points in southern Texas. Laboratory breeding stocks were maintained over winter. Several colonies of *B. gelechiae* were released early this spring on native flora and releases on cotton were begun when the first blooms appeared. A new parasite, *Bracon greeni*, and a lady beetle, *Chilomenes sexmaculata*, were received from India the last of April and are being reared in the laboratory and released.

Relation of Cultural Practices to Pink Bollworm Control (A. J. Chapman and L. W. Noble): The program requiring completion of stalk cutting and plowing by August 31 in the Lower Valley area has proved very effective in pink bollworm control. The marked decrease in infestation level in this area since the 1952 crop is attributed primarily to thorough early stalk plow-up with later destruction of volunteer seedlings and sprout cotton so as to maintain practically a host-free period between crops.

The desirability of uniform planting dates and plant growth was emphasized in the last two years' experience. Late cotton suffered severely from pink bollworm attack. In 1953 the early maturity of unirrigated cotton caused a heavy migration of the insect to late maturing fields and especially to those receiving late irrigations. In many of these fields losses were heavy.

Cotton Varietal Susceptibility to Pink Bollworm Damage (Ivan Shiller, in cooperation with plant specialists of the Texas Agricultural Experiment Station and Agricultural Research Service): None of the commercial varieties or strains of cotton grown in the United States have been found to be resistant to pink bollworm attack.

The staff is alerted to the possibility that individual plants growing in pink bollworm infested areas may show resistant qualities. Any findings of this kind will be brought to the attention of the Texas Agricultural Experiment Station which has taken leadership on this project. Seed of hybrids of various species of Gossypium furnished by Dr. T. R. Richmond of Texas Experiment Station were grown at Brownsville last year, but the number of plants was too

few from which to draw conclusions. Dr. J. R. Meyer of the Mississippi Experiment Station has furnished seed of a number of hybrids with the request that resulting plants be exposed to controlled numbers of pink bollworms to determine if there is any indication of resistance.

Hibernation (A. J. Chapman, Ivan Shiller, G. L. Smith, O. T. Robertson, C. R. Parencia, and representatives of Control Project): Pink bollworm hibernation tests conducted last year at Brownsville, Port Lavaca, Waco, Greenville, Lubbock, and Vernon, Texas and at Chickasha, Oklahoma are being repeated with the addition of a new location, Mount Pleasant, Texas. Climatic conditions in these localities range from subtropical and humid at Brownsville to cold and arid at Lubbock, and cold and humid at Mount Pleasant. A wide range of soil conditions is also represented. In each of these tests pink bollworm infested seed cotton is utilized in 4 series of 20 cages simulating practical conditions, a total of 80 cages in each locality. These are equipped with traps and the moths are removed and determined every day.

To date, moth emergence has just begun at the more northern locations. The emergence during March and April at Brownsville shows a higher percentage survival than in last year's tests in this area. This difference in survival is attributed largely to weather conditions during the first part of September. That period for last year's tests was hot and dry with soil temperatures sufficiently high to cause larval mortality while the current tests were begun immediately following rainfall, and subsequent soil temperatures were much lower than in the previous year.

Seasonal Abundance of the Pink Bollworm (McGarr, Richmond, Walton and Staff of Pink Bollworm Control Project): Bloom inspections were made in Cameron County primarily to locate prospective fields for use in insecticide experiments. These inspections were begun as soon as blooms appeared in the early plantings. Extensive inspections were made later by the Pink Bollworm Control Project in the four Valley counties. The records made by the two groups are summarized in the table below.

| County | Year | Number of fields Inspected | Number of fields Infested | Number of blooms Inspected | Number of blooms Infested | No. worms per 100,000 blooms |
|---|---|---|---|---|---|---|
| Cameron | 1954 | 209 | 59 | 426,470 | 156 | 37 |
| | 1953 | 359 | 258 | 819,848 | 2,648 | 323 |
| Hidalgo | 1954 | 176 | 20 | 487,851 | 104 | 21 |
| | 1953 | 373 | 226 | 1,237,972 | 1,197 | 97 |
| Willacy | 1954 | 79 | 2 | 159,362 | 2 | 1 |
| | 1953 | 159 | 107 | 401,589 | 802 | 200 |
| Starr | 1954 | 45 | 10 | 88,320 | 18 | 20 |
| | 1953 | 70 | 31 | 137,339 | 162 | 118 |
| Four above counties combined | 1944 | - | - | 536,223 | 190 | 35 |
| | 1945* | - | - | 2,818,381 | 189 | 7 |
| | 1946* | - | - | 6,020,168 | 198 | 3 |
| | 1947 | - | - | 2,273,459 | 115 | 5 |
| | 1948* | - | - | 5,450,310 | 601 | 11 |
| | 1949 | - | - | 5,521,741 | 461 | 8 |
| | 1950* | 1,431 | 223 | 4,133,262 | 1,425 | 34 |
| | 1951 | 1,477 | 211 | 3,191,534 | 1,006 | 32 |
| | 1952* | 1,031 | 956 | 1,384,530 | 34,091 | 2,462 |
| | 1953* | 961 | 622 | 2,596,748 | 4,809 | 185 |
| | 1954 | 509 | 91 | 1,162,003 | 280 | 24 |

* Cotton stalk destruction completed by August 31. Note that when stalks were not cut early, there was an increase in infestation the following year.

Alternate Host Plants of the Pink Bollworm (Ivan Shiller, G. L. Smith and Jack Sherrer): The pink bollworm has been found developing on 21 plants other than cotton in the United States to date. It is known to hibernate and live over winter on at least 9 of these plants. As a part of the 1954 work on this phase of investigations many species of Malvaceae were transplanted into the large screen cage where they will be exposed, together with cotton, to a heavy concentration of pink bollworm moths. Also, an effort is being made through the State Experiment Stations to obtain seed of species of Malvaceae from all of the southern states for planting in the cage to determine if they are likely to serve as alternate host plants of the pink bollworm. The State Experiment Stations in the Cotton-belt have been requested to gather information, incidental to their other activities, on the distribution and abundance of the mallows likely to serve as pink bollworm hosts. Most of the stations have indicated that they will cooperate in this undertaking.

Physiology, Morphology, Histology, and Biochemistry Investigations (E. W. Clark and Dan Chadbourne): The laboratory for this work is now organized and fairly well equipped with benches, glassware and basic laboratory apparatus.

Sectioning and staining techniques have been developed which give excellent sections of from 5 to 10 microns thickness. Slides are now being prepared of serial cross-sections of larvae and pupae of known ages for histological and cystological examination to determine the normal picture.

Investigations of various methods of detecting infested cotton seed are being carried out. One of us (Clark) visited the USDA Grain Laboratory and Kansas State College which are both located in Manhattan, Kansas and examined the methods used there with infested grains. At present two methods are under experimentation. The first method is X-ray and it looks promising because not only is it fast, but results in a permanent record which offers a considerable amount of data. The other is the flotation method in which aqueous solutions of varying specific gravities are used to float off the bad seed. The development of an accurate method of segregating infested seed would effect a great saving of time required at present where every seed is cut and examined.

Preliminary studies are being made on the problem of tagging the adult moths for future flight studies. A number of flourescent dyes and chemicals have been tried not only to seek a positive technique for marking the adults but also to anticipate other problems that might arise.

Preparations for studies of the fat and water content of the larvae, pupae, and adults are now underway. Qualitative amino acid analyses are being carried out at present on larvae in various instars.

Methods of Destroying Pink Bollworms in Seed Cotton, Cottonseed, and Gin Waste (D. H. Currie, O. T. Robertson and O. L. Walton): Studies of the mechanical kill of pink bollworms during the processing of cotton began in West Texas early in 1953. Results from a pilot test at a modern gin located in Lamesa, Texas indicated a high mortality in cottonseed collected under the gin stand. Further studies

were made at 9 gins in the Lower Rio Grande Valley and at 3 gins in the Coastal Bend area of Texas. The results of the studies at the 12 gins were erratic, so conclusive data were not obtained. In the spring of 1954, in collaboration with the Division of Cotton Ginning Investigations, studies were made at the U.S.D.A. Ginning Laboratory, Mesilla Park, New Mexico, using 2 bales of picked cotton and 4 bales of snapped cotton. Nine different combinations of machinery were used in these tests, ranging from the minimum amount of equipment necessary for ginning to an elaborate setup. Results of tests with a minimum amount of machinery indicated a survival in the cottonseed under the gin stand of 20.85 percent and with the addition of machinery the percent survival decreased to 0.31 percent survival in the elaborate setup.

A separate test with heavily infested cottonseed in a special seed handling system indicated a 29.7 percent kill from stand to seed storage. Further work on treatment of cottonseed in the seed handling system is under study.

In the gin studies it was found that some machines killed more larvae than others and that the higher speeds of saws, cleaning cylinders, etc., increased the kill considerably.

Several types of equipment have been tested for mechanical treatment of trash. Dual fans have been approved for trash treatment provided they are installed and operated under certain Government specifications. A trash sterilizer was tested but it did not prove satisfactory. It will be further tested after modifications have been made. A heavy steel roller system for trash treatment has been built and will be tested during the coming ginning season in the

Lower Valley of Texas. Also, a grinding-type machine is to be installed and tested for trash treatment during the coming gin season. Some work has been done on single conventional fans for trash disposal.

Several tests have been made with the entoleter which is a device for killing insects in dry grain. Efforts are being made to adjust it so that it will kill pink bollworm in cottonseed without injuring the seed. Studies are in progress on this apparatus.

Biology Studies of the Pink Bollworm (M. Lukefahr, J. A. Griffin, L. W. Noble): Previous work on this phase of investigations has been conducted in the arid region of western Texas. Work is presently underway at Brownsville to obtain information on the life history and habits of the insect under different climatic conditions. Observations were begun with the overwintered generation. Records are being obtained on the duration of the pupal stage, longevity of the adults, egg laying capacity and time of day of moth emergence and oviposition. The records are not as yet complete for this generation. Records are now being obtained on the developmental period of the first spring generation feeding on squares.

Bioclimatic Cabinet Studies (C. N. Husman and others to be assigned): The object of constructing 5 cabinets for studies of the pink bollworm and Mexican fruitfly was to determine in advance what the damage potentialities of these pests might be if and when they spread more widely in this country. In the case of both insects, however, we must learn how to propogate them successfully under

controlled conditions before they can be carried along satisfactorily in the cabinets. Work along this line is underway.

The cabinets were put under test on January 18 to determine if they would meet the severe requirements specified in the construction contract. On February 27, 1954, they were found satisfactory and were accepted.

The tremendous capacity of these cabinets is illustrated by the fact that in 1 hour temperature was lowered 80° F., from 96° to 16° F. and raised 126° F., from -2° to 124° F. Relative humidities were likewise raised or lowered 80% in 1 hour with temperatures ranging from -5° to 125° F.

Invaluable assistance in regulating these cabinets and in making suggestions and changes that assured more accurate and reliable operation was lent by the Fruit Insect Research Section. Two men, Messrs. N. E. Flitters and W. E. Stone experienced in designing and operating equipment of this type, were assigned by that Section to Brownsville during the entire test period. Mr. J. P. Hollingsworth of the Farm Electrification Section, A.R.S., also assisted by checking the engineering aspects of the cabinets.

Migration Studies (P. A. Glick): Tentative arrangements for the use of a Department of Agriculture owned Piper Cub airplane for the conduct of studies of moth migration in the upper air have been made.

Information obtained from military authorities at Fort Sam Houston, San Antonio, indicates that the plans for using captive balloons for migration studies will have to be abandoned since such balloons are no longer used by the military.

Light Traps (T. R. Pfrimmer, P. A. Glick, and W. L. Lowry): Studies of the value of various radiations and traps for capturing pink bollworm moths are being continued in cooperation with Agricultural Engineers of the Section of Farm Electrification.

Insect collections in light traps operated in the Lower Valley during the winter and this spring indicate a very low pink bollworm carryover in fields that matured early last season due to lack of moisture. Pink bollworm moths were caught only in sections where irrigation water was available to keep cotton fruiting heavily late in the season. Traps operated in the Coastal Bend area showed considerable pink bollworm moth activity during February and March, and one moth was caught at College Station the middle of March. Traps with 3 different kinds of lights were operated on the laboratory grounds at Brownsville, and the response of various insect orders to the different types or intensities of light varied widely. The percentage of the total collections represented by Lepidoptera and Diptera increased as the intensity of visible and ultraviolet or near ultraviolet light decreased while Coleoptera and Ephemerida were the reverse. Of 11 orders represented in the winter collections, Coleoptera, Diptera, Lepidoptera, and Ephemerida made up approximately 95 percent of the total number of specimens collected in each trap.

Mechanical Equipment (C. N. Husman): Several commercial companies which manufacture shredders, strippers, etc. have shown considerable interest in the studies to be made on the control of pink bollworm by farm equipment and have offered to lend us equipment to conduct these studies. This equipment will be observed, and types and modifications will be suggested for engineering evaluation by the Texas Experiment Station which has the leadership on this project. The Center personnel will cooperate by determining direct kill of pink bollworms by the shredders and by the sun after the debris has been exposed on the soil as now recommended in South Texas. This will involve examination of the debris and caging of samples of it for moth emergence.

A small machine shop is now being set up; hand and power tools have been ordered. This equipment is required to meet many needs around the Center.

A three-in-one constant temperature cabinet was constructed by using a secondhand electric refrigerator and installing two smaller cabinets within it. The cabinets have separate thermostat switches which control the heat required. A 60-watt light bulb is used for the heating unit. The large cabinet is running at 50° F. and the small interior cabinets are set at 60° and 70° F.

## PAPERS ON PINK BOLLWORM AND RELATED SUBJECTS PREPARED BY RESEARCH CENTER STAFF

### Papers Published During the Fiscal Year, 1954:

"Trends in Pink Bollworm Control in The Laguna of Mexico" by C. S. Rude (Jour. Econ. Ent. 46 (6): 1038-41).

"Value of Pesticides in Raising Standards of Living and Health" by F. C. Bishopp (Agr. Chem. 9 (4): 60-61, 126-129).

"Where Do We Stand on Cotton Insects" by F. C. Bishopp (Cotton Gin and Oil Mill Press 54 (6): 44).

"Can They Bump The Bollworm" by F. C. Bishopp (Agr. Leaders Digest, April, 1954, pp 22-23, 3 figs.).

"Legislation Relating to Insecticides and Their Use" by F. C. Bishopp (1953 Proceed. of N.J. Mosq. Exterm. Assn., pp 123-124)

### Manuscripts presented at the Southwestern Branch of the Entomological Society of America Meeting at Dallas, Texas:

"Weekly Applications of Insecticides for Control of Pink Bollworm and Boll Weevil" by R. L. McGarr.

"Studies on the Mechanical Kill of Pink Bollworm During The Processing of Cotton" by O. T. Robertson and D. H. Currie.

"Tests to Determine the Response of the Pink Bollworm Moth and Other Insects to Certain Ultraviolet and Visible Radiation" by Perry A. Glick and J. P. Hollingsworth.

"A Preliminary Report on the Use of Light Traps for Control of the Pink Bollworm" by Theodore R. Pfrimmer, M. J. Lukefahr, and J. P. Hollingsworth.

"Hibernation Experiments on the Pink Bollworm in Texas and Oklahoma" by A. J. Chapman and L. W. Noble.

"Organization and Objectives of the Pink Bollworm Research Center, Brownsville, Texas" by F. C. Bishopp.. [illegible]

Other Papers Prepared:

"Tests on Dielectric Treatment of Cotton Seed for Destroying Pink Bollworms" by W. L. Lowry, A. J. Chapman, F. T. Wratten, and J. P. Hollingsworth - for publication in Jour. Econ. Ent. (revised from paper read at Galveston, Texas meeting in 1952).

"Investigations of the Pink Bollworm and Other Cotton Insects in the El Paso, Texas Area 1944-54" by L. W. Noble - for possible publication as a technical bulletin.

"Entomology and the Public Health" by F. C. Bishopp - for publication in Agricultural Chemicals.

"Expanded Research on the Pink Bollworm a Necessity" by F. C. Bishopp - for publication in 1954 Yearbook, Texas Cotton Ginners Association.

"Progress in Cooperative Pink Bollworm Research" by F. C. Bishopp - paper read at Cotton Insect Control Conference, Memphis, Tennessee.

"Mechanization Necessary in Fighting the Pink Bollworm" by F. C. Bishopp - for publication in Cotton Trade Journal.

"Status of Pink Bollworm Research" by F. C. Bishopp - talk presented at Cotton States Branch Meeting 1/25-27/54.

"Defoliation as a Means of Cotton Insect Control" by F. C. Bishopp - paper read at Beltwide Cotton Defoliation Conference, Memphis, Tennessee Jan. 14-15, 1954.

"War on the Pink Bollworm" by F. C. Bishopp - for publication in Cotton Trade Journal.

BROWNSVILLE, TEXAS

Permanent Personnel

| Name | Title | Assignment |
|---|---|---|
| F. C. Bishopp | Coordinator | Director and Coordinator, Pink Bollworm Research |
| A. J. Chapman | Project Leader | In general administrative and technical charge of laboratory |
| E. W. Clark | Entomologist | Physiological, morphological, histological research |
| D. S. Chadbourne | Entomologist | Physiological, morphological, histological research |
| D. H. Currie | Entomologist | Studies of mechanical kill of pink bollworm in processing of cotton |
| W. J. Eitel | Entomologist | Light trap investigations (after May 4) |
| P. A. Glick | Entomologist | Light traps and identification of insects |
| J. W. Griffin | Entomologist (assigned by Alabama) | Biology and insecticides (after April 6) |
| C. N. Husman | Equipment Engineer | Designing, adapting, and maintenance of equipment |
| W. L. Lowry | Entomologist | Toxicological investigations |
| M. J. Lukefahr | Entomologist | Biology studies |
| R. L. McGarr | Entomologist | Insecticides, field inspections and other program duties |
| J. M. McGough | Entomologist | Pink bollworm parasites and predators |
| D. Morris | Writer | Intermittent work on manuscripts |
| L. W. Noble | Entomologist | Reports and program duties including biological studies |
| T. R. Pfrimmer | Entomologist | Light traps (transferred to Tallulah, La. April 30, 1954) |
| C. A. Richmond | Entomologist | Insecticides, field inspections, and gin studies |
| Ivan Shiller | Entomologist | Insecticides, hibernation experiments, host plants |
| O. L. Walton | Entomologist | Ginning studies, insecticides |
| M. A. Taylor | Admin. Assistant | Fiscal and administrative |
| E. L. LaPierre | Clerk-Typist | Clerical |
| E. O. Schunter | Clerk-Typist | Clerical |
| F. B. Weeks | Clerk-Typist | Clerical |
| J. C. Gonzalez | Laborer | General labor |

Seasonal Personnel

| Name | Title | Assignment |
|---|---|---|
| C. Cantu | Field Aid | Biological studies |
| Dale Mitte | Field Aid | Biological studies |

LUBBOCK, TEXAS

Permanent Personnel

| | | |
|---|---|---|
| O. T. Robertson | Entomologist | In charge of sublaboratory, ginning studies, and hibernation tests |
| W. J. Eitel | Entomologist | Hibernation and gin studies (until May 4) |

PORT LAVACA, TEXAS

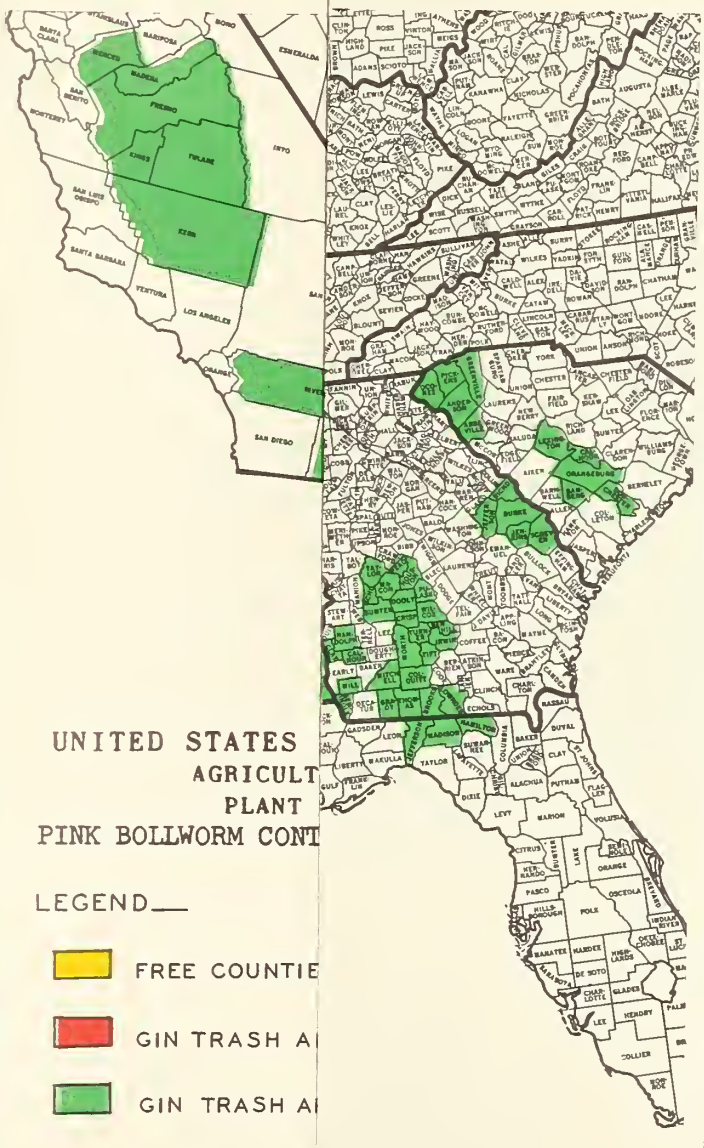
Permanent Personnel

| | | |
|---|---|---|
| G. L. Smith | Entomologist | In charge of sublaboratory, hibernation, host plants, and insecticides |
| J. D. Sherrer | Entomologist (assigned by Arkansas) | Insecticides, host plants, and biology |

TORREON, COAH., MEXICO

Permanent Personnel

| | | |
|---|---|---|
| C. S. Rude | Entomologist | In charge of sublaboratory, insecticide tests and control activities |


UNITED STATES
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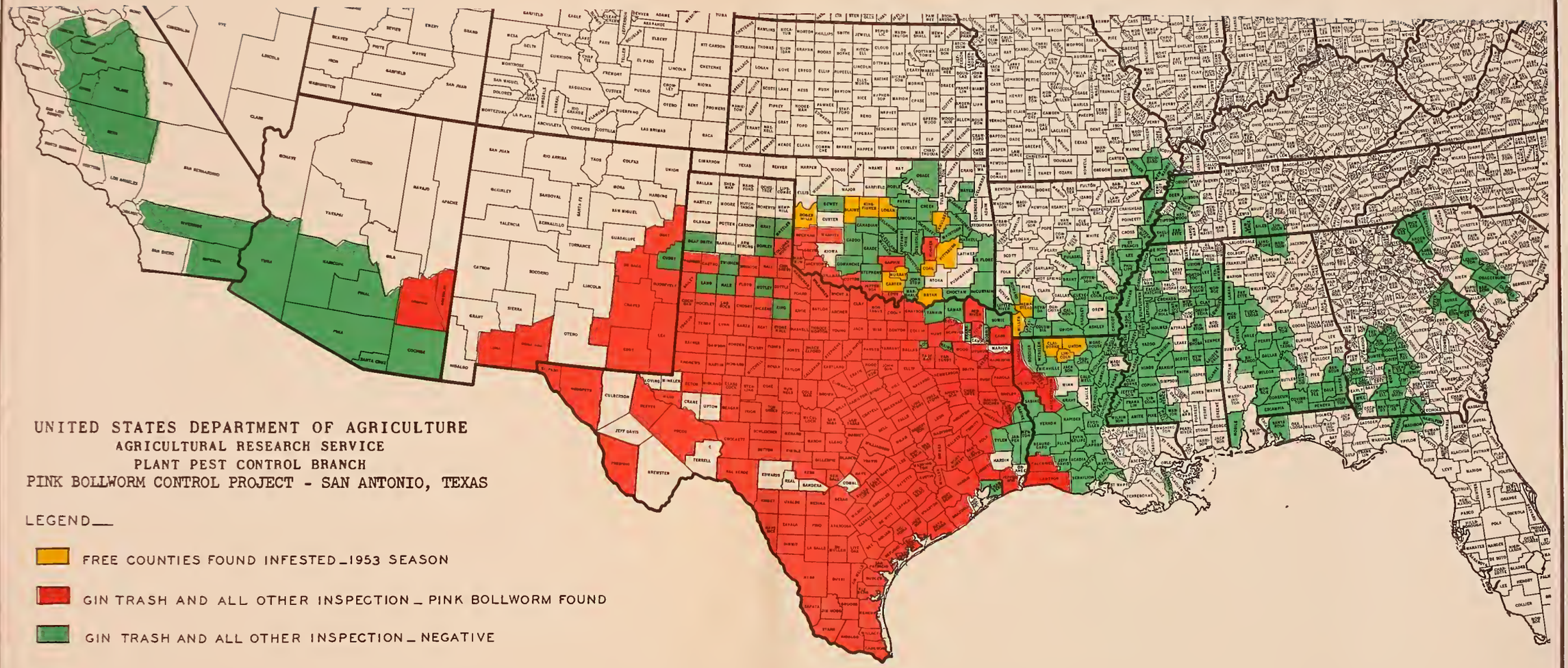
# INSPECTION FOR PINK BOLLWORM _ 1953 CROP



UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
PLANT PEST CONTROL BRANCH
PINK BOLLWORM CONTROL PROJECT - SAN ANTONIO, TEXAS

LEGEND__

- FREE COUNTIES FOUND INFESTED _ 1953 SEASON
- GIN TRASH AND ALL OTHER INSPECTION _ PINK BOLLWORM FOUND
- GIN TRASH AND ALL OTHER INSPECTION _ NEGATIVE